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Research & Development

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DISSECTION SURVEY Page 13

What is the fate of Freddie the Frog?

INTERNATIONAL MAGAZINE OF RESEARCH AND DEVELOPMENT

R&D

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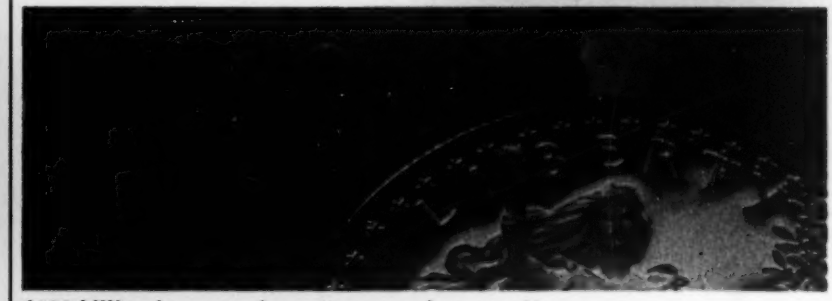

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Dick Johnson leads research to make aging airplanes safer at Boeing's Everett, WA, facility. *Photo by Tim Davis.*

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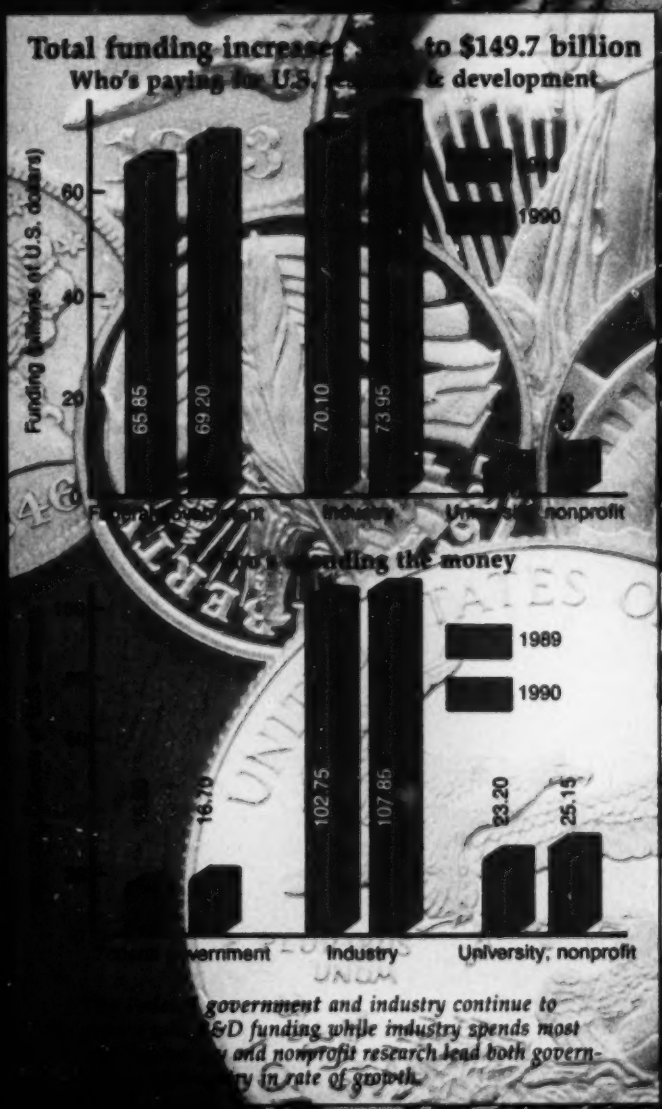

Total funding increase
to $149.7 billion
Who's paying for U.S.
& development
Funding billions of U.S. dollars
60
40
20
65.85
69.20
70.10
73.95
1990
nonprofit
ding the money
1989
1990
102.75
107.86
23.20
25.15
Industry
University, nonprofit
government and industry continue to
&D funding while industry spends most
and nonprofit research lead both govern-
in rate of growth

There's No Joy in This Year's $150 Billion for R&D

Don't let the big numbers fool you—there won't be a lot of new dollars for research this year.

By Tim Studt, Associate Editor, R&D magazine

A FEDERAL BUDGET deficit that won't go away, money costs that are twice what our international competitors pay, and continued short-term thinking by corporate America are among the harsh economic realities that R&D budget managers face in 1990.

Add to this the political effects of a thawing cold war, a precipitous drop in defense spending, and renewed saber-rattling with Japan and Europe over trade issues, and you have a global picture filled with uncertainty.

The net result of these factors is *R&D* magazine's forecast that government, industry, universities, and other nonprofit research centers will spend $149.7 billion on R&D in the U.S. this year.

If that sounds like a lot of money, it's not. Our $130.8-billion forecast for 1989 has been adjusted to account for the changing R&D environment in the past 10 years (see box).

As the accompanying charts show, the 1990 forecast breaks down as follows: The Federal government will spend $69.2 billion, up 5.1% from last year's revised figure. Industry will devote $73.95 billion, a 5.5% increase from a year ago. Universities and nonprofit centers will fork up $6.55 billion, a whopping 12.9% increase over 1989's figure.

As in the past, industry will actually carry out the bulk of the research, $107.85 billion or 72% of the total. Federal labs will perform $16.7 billion (11.2%), and universities and nonprofit centers—again showing growth—will do $25.15 billion (16.8%).

A declining, but still large, defense budget, entitlement program growth, and the budget deficit restrict any real Federal R&D growth.

In recent weeks, the Bush Administration's support for many popular

Increases in U.S. R&D continue to trail those of Japan and Europe.

R&D programs has been faltering. Such high-visibility programs as Sematech, DARPA (especially its HDTV project), the Dept. of Commerce's Technology Assessment Program, and the Pentagon's Manufacturing Technology Program are among those coming under close White House scrutiny for possible cutbacks.

The area most severely affected by budget constraints has been defense R&D, especially aerospace research. Of the $61.9 billion in Federal R&D obligations for 1989, the defense share was $37.6 billion or 60.8%.

Declining defense share

Although the absolute value of defense spending increased 6.2% from 1988 values (due to procurement items), its share of total government research obligations dropped almost 2%, with even larger drops projected for the next several years.

With world political events making military readiness almost secondary to industrial competitiveness, defense R&D development will continue to shrink.

"In the long term, I think that the [defense] research institutions are going to get hit hard," says Kenneth Smith, vice president for research at Massachusetts Institute of Technology (MIT), Cambridge. With most defense programs surviving the FY1990 budget process, he predicts that FY1991 will be the year for "big hits."

"With the developments in Europe, you're not going to sustain a $300-billion military budget," says Kosta Tsipis, director of MIT's Program in Science & Technology for International Security. "And since the ratio of R&D to procurement is fixed at 47%, you're going to see R&D go down."

The defense slowdown already has depressed the value of aerospace industries. Most aerospace companies are being forced to accept smaller operating margins and many others are taking charges against their backlog of fixed-price R&D contracts.

The Gramm-Rudman budget-deficit law, which mandates a FY1990 $100-billion deficit ceiling, adds another layer of woe to defense research. A FY1990 sequester was ordered into place in October 1989 by President Bush, half of which by law must be absorbed by the Dept. of Defense. Analysts are predicting that Gramm-Rudman pressures will force 2% annual real declines in defense budgets for FY1991 through FY1994.

The DOD comptroller already has requested that the armed services make $180 billion in budget cuts over the next four years.

Most nondefense research agencies had substantial funding increases last year. The 1989 R&D obligations, according to NSF sources, were:

- National Institutes of Health: $6.8 billion, up 8.0% from 1988

Most defense R&D programs survived FY1990 budgets, but FY1991 will be the year for 'big hits.'

- NASA: $5.7 billion, up 31.4%
- Dept. of Energy: $5.5 billion, up 8.8%
- National Science Foundation: $1.7 billion, up 8.6%
- Dept. of Agriculture: $1.0 billion, no change
- Dept. of Commerce: $405 million, up 4.3%
- Dept. of Transportation: $335 million, up 10.2%.

An industrial balancing act

The static situation in industrial R&D funding reflects a balancing of short-term "survival" and long-term growth efforts by companies. Many companies use survival funding to support formerly neglected manufacturing operations. The profits from these existing product lines help pay for long-term developments.

DuPont spends 55% of its $1.4-billion R&D budget on short-term projects and the remainder on projects with 5- to 10-year lives. As their long-term projects succeed, the Wilmington, DE, chemical giant needs even more research. "The balance is not only how much can you afford today, but the implications of what you spend today as far as demanding even more spending in the future," says Alexander MacLachlan, senior vice president of technology.

DuPont and other companies also are trying to get more out of their R&D money.

"Companies are much more interested in leveraging their R&D dollars," says MacLachlan. "Industry, and not just U.S. industry, is working more closely with universities to do early technological development that otherwise might have been done internally, but because of cost, perhaps can be done more expeditiously or more cheaply in universities.

"We're also starting to involve ourselves with government labs because they are a rich source of technology," MacLachlan continues. "But this is a complicated area and slowed by a lot of suspicion [of the bureaucracy]."

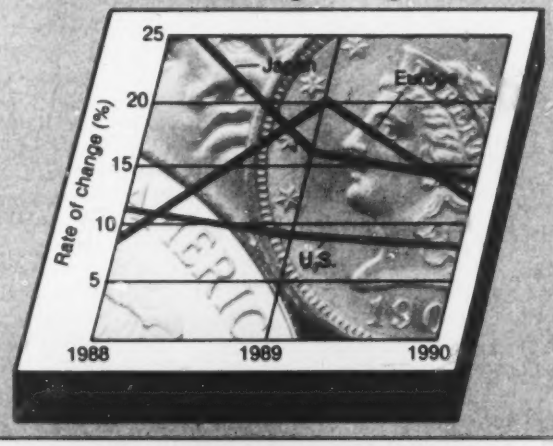
Most industrial managers are confident of their companies' success. "The funding I have is commensurate with the opportunities that I'm working with," says Carl Scaccia, director of R&D at Ashland Chemical, Columbus, OH. "If better and higher levels of opportunity were to be presented, we would get additional funding."

Investment inequities

Foreign competitors invest more, save more, and pay less for investments.

Our funding forecast reveals a continuation of proportionately lower U.S. R&D spending than that of our major industrial competitors, Japan

Industrial R&D spending trends



In 1990, both Japanese and European companies will increase their R&D more than 12%, while U.S. company increases will be less than 8%. Forecast is made from Securities and Exchange Commission data and is courtesy of Schonfeld & Associates, Evanston, IL.

Changing the sampling procedure

R&D MAGAZINE'S 1990 funding forecast shows a 5.6% increase over our revised 1989 figures. Although this increase improves upon 1989's 4.6% increase, it indicates a real funding growth of less than 1% when adjusted for inflation (based on the Cahners Economics Production Price Index of 4.9%, which is more appropriate for research costs than the Consumer Price Index). Using constant 1982 dollars, the increase is 1.3%.

This year's figures have been adjusted upward from the actual numbers used in the 1989 forecast. This adjustment reflects a new sampling procedure by the National Science Foundation that includes industries inadequately sampled in the past.

Previous funding forecasts used a sampling procedure established in 1981. Each year the largest R&D performers were surveyed, and total funding was obtained by imputing a difference for the remaining amount.

A sampling change was required when actual 1986 expenditures compared to the 1981-based survey revealed the survey to be about $7 billion low. Using a new 1987 survey indicated that more than half of this difference came from increased R&D by nonmanufacturing companies that had not been sampled.

Using the 1987 sampling procedure, the original 1989 funding was adjusted from $130.8 billion to $141.75 billion. Of this $10.95-billion difference, $8.95 billion came from industry, mostly software development and engineering services companies.

These companies have had dramatic increases in their R&D during the past 10 years. Most software companies and manufacturing research centers didn't even exist in 1981.

Additional industrial increases came from R&D in communication service companies, independent research laboratories, utilities, and small companies. The 1981-based survey was heavily biased in favor of large companies.

The remaining adjustment in 1989 funding went to government research ($1 billion), which was not as hard hit by last year's general budget cutback as originally forecast, and university performance ($1 billion).

The U.S. must face the realities of a global economy, if it is going to have any future.

and Europe (see chart). The Japanese especially are investing in their companies at an astounding rate:

- The ratio of capital investment to gross national product (GNP) in Japan will climb to nearly 25% in 1990, up two percentage points from 1989. In the U.S., this ratio will reach 9%, a one percentage point decrease from last year.
- Most Japanese technology companies will up their annual R&D budget by 14%, compared with increases by U.S. companies of 9%.
- This year's ratio of nondefense R&D to GNP is projected at 2.8% in Japan and 2.0% in the U.S.

Some of this investment will satisfy growing internal demand; however, Japan's long-term technological growth still is outpacing U.S. growth.

One reason the Japanese can invest more is that their real after-tax cost of funds is only 2.5% (for 1989). In the U.S., the cost of funds is 5%.

Personal savings rates affect the cost of money. Japan's household savings rate, as a percent of disposable income, is 20%—in the U.S., it's 6%

A lower savings rate imperils America's future development capabilities according to physicist George Hatsopoulos, CEO of Thermo Electron Corp., Waltham, MA, and chairman of the Federal Reserve Bank of Boston.

"Foreign investment in U.S. land, corporations, and securities [which finances our growth] induced by a low dollar cannot continue indefinitely," says Hatsopoulos. "Ultimately, inadequate national saving must translate into reduced investment."

A global viewpoint

U.S. companies are finding ways to beat foreign competition.

In one situation, companies are concentrating on a small number of long-term, high-tech ventures. Dow Chemical, for example, is spending a major portion of its more than $2.5-billion R&D budget on such ventures as engineering thermoplastics and pharmaceuticals. They are prepared to absorb losses for five years or longer to develop new products.

In another situation, two or more companies are combining their R&D capabilities. Dow bought a majority stake in Marion Labs, Kansas City, MO, so it could get into pharmaceuticals quickly. Ford, GM, and Chrysler formed a cooperative research group to investigate structural composites. Squibb formed a technology-sharing alliance with Denmark's Novo to produce a new insulin product.

"The days of doing it all yourself are gone," says John McTague, vice president for research, Ford Motor Co., Dearborn, MI. "The key [to forming a joint venture] is to find things that are mutually beneficial."

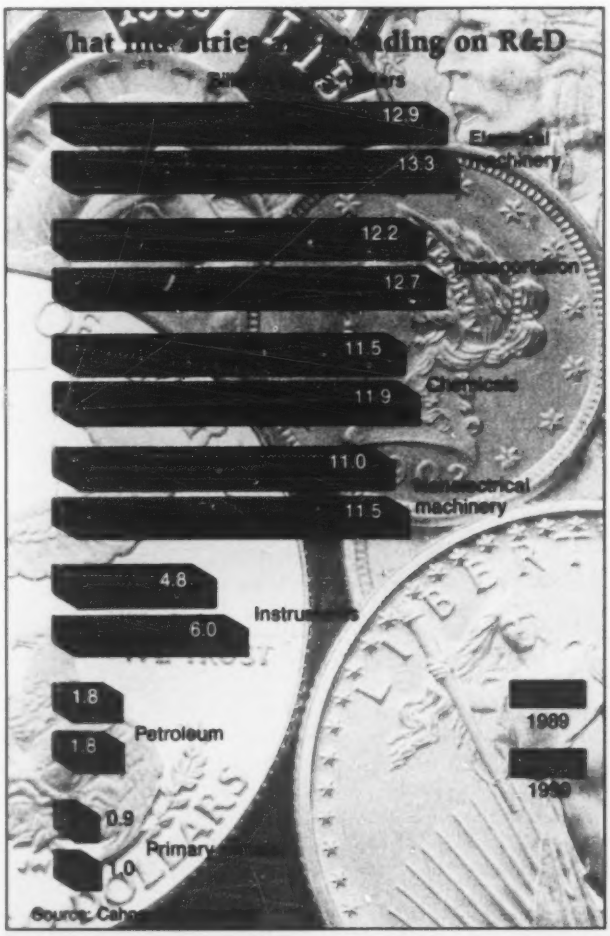
Some industries are keeping pace with foreign competitors. "In motor vehicles, the U.S. and Japan are dead on at 3% of sales [for research]," says McTague.

In aerospace, Seattle's Boeing has formed technical alliances with Japanese heavy industrial manufacturers. But the handwriting is on the wall—the Japanese have made aerospace their next market objective.

The U.S. aerospace industry has been its leading exporter for the past four years, yet "the aerospace products on which this trade surplus is based draw on technologies developed 10 to 25 years ago," says Edward Hennessey, Jr., chairman of Allied-Signal, Morristown, NJ.

The industry position has remained strong despite reductions in government-funded support of aeronautical R&D, but long-term technological leadership has weakened.

"U.S. aerospace, like all industries, must face up to the realities of a global economy if it's going to have any future," says Hennessey. **R&D**



Despite an expanding economy for the eighth consecutive year, industrial R&D increases in 1990 won't match inflation levels in most sectors. The exception: instrument industries, whose growth continues to beat inflation.

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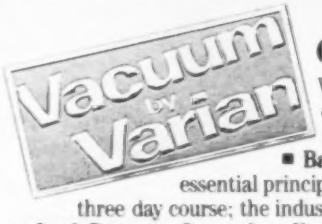

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